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ABSTRACT

Children aged three to six were shown drawings of three objects that were identical except for differences in size in one or both dimensions. Each child was asked to determine if one object was the tallest. A missing feature model was not supported, since a child was often correct for some items and incorrect for others. Errors were partially predictable by certain properties of the objects, such as preponderance of curved or straight lines. In a second experiment, the same children were presented with a different set of pictures that included some from the first experiment, now identified with new names (e.g., "three houses" became "three arrows"). Identification of tallness followed the same pattern as in the first experiment, with many children providing different responses for identical but differently labeled items. The older children made only half as many reversal errors as the younger: both groups erred systematically, but according to different criteria. This research supports the idea that concepts such as "tall" develop not by the progressively restrictive accrual of features, but by a progression from idiosyncratic, object-bound attribution to an eventually universalized class-bound attribution. (JB)

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THE CHILD'S ACQUISITION OF "TALL": IMPLICATIONS FOR AN ALTERNATIVE VIEW OF SEMANTIC DEVELOPMENT

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A predominant view in semantic development research is based on certain assumptions: (1) that word meanings can be decomposed into lists of features; (2) that semantic development consists of the addition and/or subtraction of such features to a set that is paired with a single lexical item: and (3) that these features are psychologically real and can be used to predict children's errors in word use.

There are a number of debates within this approach: whether features are mostly added or subtracted, whether the first features to be acquired are mostly perceptual or functional, whether features defining polarity are acquired first or last, and so on. But generally, the three assumptions are accepted.

There is no doubt that this approach has greatly increased our understanding of word meaning, especially when it is used in conjunction with theories about nonlinguistic strategies (Clark, 1979). We would like to suggest, however, that the acquisition of many word meanings may be conceptualized in an alternative way that is not so bound to these assumptions. The approach suggests that the decomposition of word meanings into such features, whether criterial or not, comes quite late in the acquisition of word meanings and that it is an analytic tool imposed by the language learner on an already functioning language system. There may be other features that are criterial and present from the start, but they are not usually evoked in the definition of a word's meaning. Rather, they are presupposed and tend to have different properties. Features of this second type have been called ontological features (Keil, 1979) and will not be discussed further here.

To be more specific, we propose that many word meanings--for both predicates and terms--are acquired first by means of exemplars, that they are inextricably tied up with the original instances from which they are learned, and that only later are the other criterial and more invariant features abstracted.

In many respects, this view is hardly new. Rosch's (1978) work on natural categories suggests that children first learn conceptual categories at the so-called basic level and that they tend to learn the most central or prototypical members of such categories first, and only later the more peripheral or atypical members. Anglin (1977) has developed this notion, arguing that the over and underextensions of various terms in development can be explained by such a prototype model.

Our proposal is somewhat different from a prototype theory of word acquisition. The closest view to ours is Carey's (1978) "missing features-plus-haphazard-example theory." Carey suggests that the child

may acquire the meanings of spatial terms such as "tall" by first learning idiosyncratic, object-particular meanings and later learning a more general concept that applies to all objects. Thus, the word "tall" may have different meanings for different objects. For a house, "tall" may mean "roof-to-street extent, positive pole." For a person it may mean "head-to-toe extent, positive pole." For another object, it may mean overall size or some other dimension of comparison such as narrowness. Thus, the child may learn what a tall man is and what that particular usage means, but may not have a general, abstract concept of "tall" that can be used systematically and consistently with a wider class of objects. The meaning of a modifier may be completely embedded in the objects with which it has been learned, and it may not be possible to isolate it from these objects. This view is not restricted to spatial adjectives, of course. Carey extends it to causative verbs, and it may also apply to other sorts of words, such as natural kind terms.

This view differs from a simple prototype view in that there is an entire field of exemplars associated with a word's meaning rather than one central prototype, and use of that word with novel items is governed by the degree of similarity between such items and other members of that exemplar field. Moreover, most prototype accounts have been confined to nouns and have not been extended to adjectives. Finally, our view does allow for criterial features at a different level (i.e. the ontological one).

There are, therefore, a number of precedents for our view, which can be summarized as follows. Semantic development does not always consist of the addition and subtraction of features to some unitary meaning. Rather, the meaning may be somewhat different for different objects. This is not to say that certain elements of the meaning are not always shared on all occasions of usage. Thus "tall" will never apply to abstract objects or to color properties. But within the domain of comparative spatial properties, its meaning may vary considerably from object to object. Our view does not require a complete decomposition of a word's meaning, nor does it assume that children's versions of such words are missing certain features. It also does not assume that the child's concept of "tall" depends on a single, central prototype. Instead, the meaning of "tall" is initially represented in terms of a wide number of exemplars, out of which a more abstract concept eventually emerges.

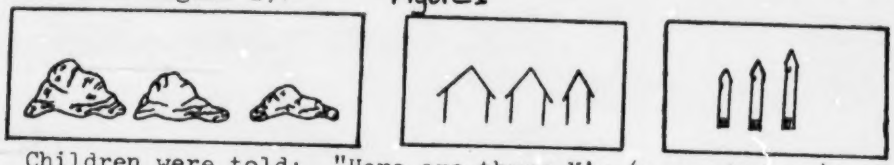
How can we test the exemplar view? Certainly, one hypothesis that emerges is that, in the course of acquiring a word such as "tall," the child, if mistaken, will not necessarily show the same mistake for all objects but will be correct for some classes of objects and not for others, depending on certain properties of these objects. If the child's meaning consists of just one list of criterial features, then the child should make exactly the same sort of mistake for all objects. Thus, if the meaning of "tall" consisted of features such as "applies to physical objects," "spatial," "has extent," "vertical direction," and "+ pole," and the child deleted the feature for verticality, "tall" might be used like "big" for all objects. Such a claim has been made in the literature, but we don't believe it is true. Carey has presented some evidence against

such feature addition views by showing that, across several tasks, children's responses could not be explained by a view that assumed that they were simply missing one or more features. This finding led Carey to propose the notion of haphazard examples, which we decided to test more directly. In our first study, we showed children pictures of several different objects and attempted to determine with which ones they could and could not use "tall" correctly. The objects ranged from familiar ones that are easy to think of as tall to ones to which "tall" cannot be so naturally applied.

Experiment 1

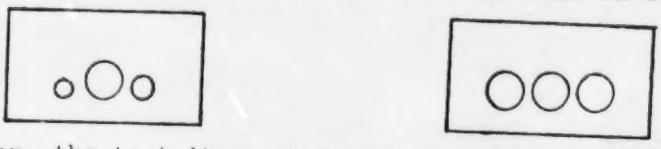
Thirty-six children ranging in age from 3 to 6 years were shown 18 drawings of such objects. The drawings varied either in height, with width held constant (hereafter referred to as tall items), or in width, with height held constant (wide items). There were three objects in each picture (see Figure 1).

Figure 1



Children were told: "Here are three X's (e.g., houses). Now is one of these the tallest, or are they all the same in tallness?" To ensure that children understood the expression "the same as" and the general nature of comparatives, we, like Carey, began with a pretest in which we asked if one item was bigger or whether they were all the same in bigness (see Figure 2).

Figure 2

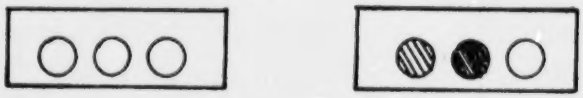


In addition, the test item set included several control drawings in which all objects were the same in all respects to ensure that the children were not simply biased to give "different" responses on all occasions.

Additional pretest items were included to ensure that children were not merely choosing the most extreme member in a set. It could be argued that, with competing dimensions such as width and height, when one dimension is held constant, children might pick the most extreme instance along the varied dimension. Thus, they might have no understanding of spatial terms or even of comparatives but could give highly systemantic answers because of certain response biases. To check for such a tendency, children were also asked, with respect to certain figures: "Which one is the darkest, or are they all the same in darkness?" And: "Which one is the biggest, or are they all the same in bigness?" The items were constant on the questioned dimension but varied along the other (see Figure 3)

Only children who passed all of these pretests were included in the study. Approximately 33% failed one or more items on the entire set of pretests and were excluded from the study.

Figure 3



The results of the first study were straightforward. (1) A child, when mistaken, was not mistaken for all items, as predicted by a missing feature model, where "tall" means something like "general spatial extent." Rather, a child was often correct for some items and incorrect for others. (2) The children's errors could be partially predicted by certain perceptual properties of the objects. Thus, they made considerably more errors on the figures that had no vertical straight lines and consisted mostly of curved lines (e.g., mountains) than on figures consisting mostly of vertical straight lines (e.g., pencils). Approximately 40% of their responses for curves were errors, while only 25% of their responses for vertical straight lines were errors. (This difference, as well as all others discussed in this paper, was significant at the .05 level.) An additional finding makes it clear that the error patterns cannot be attributed simply to a problem with discrimination between the items. Most errors occurred on the wide figures and consisted of children saying that either the widest or the narrowest was the tallest. This error pattern suggests that the children were quite sensitive to physical differences between the figures. (The differences in heights and widths were roughly the same for all sets of objects.)

Experiment II

So our first premise is satisfied: children do not use a term like "tall" in the same manner with all objects. Clearly, their usage depends on particular properties of the object. But what properties? Purely perceptual ones, like the straight--curved distinctions? Or could there be other, higher level conceptual influences? How could one isolate the perceptual from the conceptual? One technique is to use ambiguous figures, where the same physical display can be conceived of in two different ways. For example, the objects shown in Figure 1 can also be construed as blankets tossed on the floor, arrows, and rocket ships. Using such ambiguous stimuli we can ask whether, for the exact same perceptual display, a child might be correct on one interpretation and incorrect on the other. To answer this question, a second study was conducted with 48 children ranging in age from 3 to 7 years. Six ambiguous figures were used, along with all the control items from the first study. Several drawings of other objects were also included.

The same pretest items were used as in the first study. The procedure, however, had an important new component involving the use of biasing contexts. Before a test item was shown to the child, the experimenter made a short statement about what the child was about to

see next. Thus, for the house interpretation of the house/arrow figure, the experimenter would say "Now I am going to show you a picture of three houses." The experimenter went on to talk for a little while about houses and some of their typical properties. Finally, the experimenter said "Here are the houses" and revealed the picture. The child was then asked whether one house was the tallest or whether they were all the same in tallness. This procedure was repeated for all six items as well as for various control items embedded in the stimulus set. Half of the children received one interpretation (e.g., "house") and half received the other interpretation (e.g., "arrow").

In the second phase of this study, the experimenter returned about a week later, pulled out of a new container a "new" collection of drawings on different-colored paper (yellow), and presented them with a great deal of fanfare about their being new drawings of new things. Embedded within the new set were the six original figures. Before presenting one of the original figures, the experimenter gave the child a different biasing context. Thus, the objects that had been called houses in the first phase were now preceded by the following statement: "Now I'm going to show you three arrows." Arrows were then discussed for a while before the picture was shown. Except for color of paper and the location of the widest or tallest figure within the array, the figures were identical to those used in the first phase. These six drawings were randomly embedded within a larger set of novel items so as to help create the impression that all the drawings were novel ones seen for the first time. As far as we can tell, the children were generally convinced by this manipulation. It was quite rare that a child would say, for example, "Oh!" That's a house, I've seen that before." When such a remark was made, we would say, "Oh no, this is an arrow, can't you tell. Can't you see the point and the sides?" Most of the children agreed to such an argument and seemed to accept the notion that these were, in fact, new objects.

As in the first study, children were often correct on some items and incorrect on others. In fact, in striking contrast to the predictions of a missing feature theory, no child was ever wrong on all items. Some children were completely correct, however, a result that would be expected by almost any theory. Perceptual properties of the figures did account for part of the error variance. That is, there were considerably more errors on figures with all curved lines than on figures with mostly vertical straight lines. Children at all ages did show reversals for the same item. Thus, a child might be correct in using "tall" with a picture labeled "mountain" but be wrong a week later when the same picture was labeled "blankets."

If the children are divided into three age groups of roughly 16 children each, we find that while there was only a slight decrease in total number of errors with age, the youngest children (under 4 1/2 years old) had a very different pattern of errors from the middle and older groups of children (from 4 1/2 to 7 1/2 years old). Because the data for the two older groups were quite similar, in further discussion

we'll refer to both of them as "the older children."

The older children made only half as many reversal errors as the younger ones. In addition, their errors were highly systematic, as can be seen from a characterization of two different types of reversals. A reversal was labeled R+ if the child was correct on what seemed to be the favored interpretation (e.g., mountain) and incorrect on the interpretation that was conceptually less natural as "tall" (e.g., blanket). A reversal was labeled R- if the child was correct on the less favored interpretation and wrong on the more natural one. For each object, we determined which were the more and less natural uses of "tall" by having adult judges evaluate the figures and rate how common the use of "tall" was with each of the two interpretations. Incidentally, the judges all agreed that it was possible to apply "tall" to all interpretations of all objects. This seemed to be because for them, "tall" had a meaning closer to that of the abstract criterial specification based on the notion of vertical spatial extent.

The older children made more than twice as many errors of the R+ type (14) than of the R- type (6) and did better on the R+ interpretation on all but one of the six ambiguous figures. The younger children made approximately equal numbers of R+ and R- errors (22 and 23).

It is important that we demonstrate some systematicity in the reversal data so as to counter objections that the reversals might represent a random flopping about on the part of the children, who might just happen to be terribly inconsistent from trial to trial. The preponderance of R+ mistakes is evidence for such systematicity in the older two-thirds of our children. There are other reasons to believe that even the reversals in the younger group were systematic.

The younger children, when they made a reversal error, did not pick an incorrect item at random. For example, they most frequently made errors on the wide stimuli, and the errors consisted almost exclusively of the children picking the widest figure in the display, even though they could have pointed to the narrowest one or the intermediate one.

In short, the reversals at all ages do not seem to be the result of random errors, and they demonstrate that for the same perceptual display, children might be correct or incorrect, depending on how they conceived of the object in the display. One might worry that perhaps some reversals resulted from children remembering their response from the previous week and thinking that they must give a different one now that the object was labeled differently. We believe that such a strategy is highly unlikely, given the large number of responses to be remembered and given that the location of the correct response on the physical display was always moved. Moreover, if such a strategy were employed, one might expect it to become more common with age, as memory improves. In fact we noted that the frequency of reversals decreases with age.

Other differences between the older and younger children lend further support to the exemplar theory. For example, there was a shift between the two age groups in types of error patterns on the wide item displays. The older children, when mistaken, picked the narrowest item almost four times more often than the younger children, who usually picked the widest one. This increase in "narrow" errors runs contrary to a missing feature theory, in which the specification of the concept "narrow" would actually seem to require more features and more complex relations between features than "tall." By contrast, an exemplar-based model has no trouble with such a pattern, since some of the best exemplars of tall things are those that are narrow (such as skyscrapers and tall people). It is not surprising, then, that for some classes of objects, "tall" might be closely associated with the concept of narrowness. It is interesting that even several 7-year-olds made such "narrow" mistakes.

Conclusion

Taken as a whole, the two studies support our view of semantic development and suggest a coherent account of how the meaning of "tall" develops. Children do not start off with an abstract concept that is missing a few features and that is therefore systematically misapplied to all objects. Rather, they seem to first learn "tall" in highly idiosyncratic ways that are bound to particular classes of objects. As they get older, they tend to be more systematic in their uses of "tall" with classes of objects, and their errors become partially predicted by the R+/R- distinction. They also start to associate more sophisticated concepts, such as "narrowness," with various classes of objects. Finally, they discover that there is an abstract criterial relation that governs all uses of "tall," and they begin to use it instead.

This developmental sequence may seem more convincing if we consider how adults use the syncategorimatic term "good." "Good" is called syncategorimatic because so much of its meaning seems to be embedded in the objects to which it applies. A good idea, a good knife, and a good piano are good in very different ways. Moreover, for some things with which we are not so familiar, we may have a great deal of difficulty in using "good" correctly. Thus, many of us probably cannot tell a good wrestling hold from a bad one, or a good camping spot from a bad one. The theory presented here suggests that children may initially treat many terms in this syncategorimatic fashion, and much of semantic development may consist of their learning to extract from such instances higher and higher level generalizations about the term that applies to all those instances until a criterial specification, if one exists, emerges.

This is probably too strong a claim to make based on just a few studies with a spatial adjective, but we feel that it fits nicely with the other facts in semantic development research. Moreover, in more recent work with the adjectives "messy" and "full" we seem to be uncovering additional support for such a theory. There may well be concepts that are criterial from the start and others that are always exemplar-based. One direction for future research is to explore how different conceptual domains show different patterns of semantic development.

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